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Longitudinal Prediction of School Achievement for Metis and Eskimo Pupils.

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Descriptors-*Academic Ability, *American Indians, *Culturally Disadvantaged, Eskimos, *Intelligence, *Predictive Validity, Testing, Test Validity

Research in this effort attempted to review evidence of the construct validity of certain measures of intellectual potential for Canadian native pupils, and to examine the relative predictive validity, over a four-year period, of several measures of general intellectual ability for a sample of Metis pupils at Faust, Alberta, and 2 samples of Eskimo pupils. The measures of intellectual potential identified as having the least amount of cultural bias included Progressive Matrices, Safran Culture-Reduced Intelligence Test, Cattell test of g scale 2, and some subtests of Lorge-Thorndike Non-Verbal Intelligence Tests. Useful predictive validity coefficients between culture-reduced ability tests administered in 1962 and Vernon achievement tests administered in 1965 were reported for the 2 Eskimo samples. For the Metis group, culture-reduced measures did not differ significantly from conventional ability tests. (VM)

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LONGITUDINAL PREDICTION OF SCHOOL ACHIEVEMENT FOR METIS AND ESKIMO PUPILS

Reference list on back page may be of interest.

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(Paper presented to 1967 CCRE Conference on Educational Research, Winnipeg, June, 1967)

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A. Problem and Rationale

Studies previously reported by the author and his colleagues have indicated several "culture-reduced" measures which seem less bad than certain other widely-used tests in helping to assess the general intellectual potential of Metis, Indian, and Eskimo pupils of the Canadian West and North. The purposes of the paper are:

1. To briefly review illustrative cross-sectional evidence of the construct validity of certain measures of intellectual potential for Canadian native pupils.
2. To examine the relative predictive validity, over a four-year period, of several measures of general intellectual ability for a sample of Metis pupils at Faust, Alberta, and two samples of Eskimo pupils.

In the rationale underlying these studies, abilities are conceptualized as organized in a hierarchy from relatively specific abilities at the bottom to general intellectual ability at the top, resembling the models of Vernon and of Gagné. The development of these abilities takes place through a sort of cumulative transfer as innate predispositions interact with environmental conditions, along lines suggested by Hebb and by Piaget. Since environmental conditions may differ considerably from one culture to another, so may the patterning and nature of abilities at all levels of the hierarchy, as

suggested by Ferguson and by Biesheuvel. Abilities high in the hierarchy are less affected by particular environmental experiences, and hence measures of general intellectual ability with minimum cultural bias should provide least bad estimates of intellectual potential for individuals from other cultures.

B. Illustrative Cross-Sectional Evidence of Construct Validity, 1961.

This has been re-stated in the form of three main criteria for construct validity of such measures as indicated under B of the Handout, where previously-reported cross-sectional evidence of such construct validity for several measures is illustrated using as an example 147 Metis at Faust, Alberta in 1961. Table 1 shows the mean T-scores of four groups of these Metis when scored on White urban norms having a mean of 50 and standard deviation of 10; means from a replication of the Faust study in a larger sample of Metis and Indians attending school at Ft. Simpson, N.W.T., are included in this table.

Using median values over the four groups of Faust Metis, Table 2 presents a summary evaluation of nine culture-reduced (not of course culture-fair) tests in terms of : (1) First unrotated principle factor loadings (which indicate the degree to which a test is measuring the general intellectual ability factor running through a variety of ability and school achievement tests), (2) Communalities (which indicate the degree to which a test is measuring all of the various common factors running through the battery of ability and school achievement tests, and also give minimum estimates of reliability), (3) Mean T-scores based on White norms (which indicate the relative cultural bias of the various tests), and (4) Correlation with concurrent school achievement as in 1961.

It is seen that in this context the tests least badly meeting the criteria set up for measures of intellectual potential with minimum cultural bias are Progressive Matrices, Safran Culture-Reduced Intelligence Test, Cattell test of g scale 2, and some subtests of Lorge-Thorndike Non-Verbal Intelligence Tests. These tests also had non-significant correlations with sex, with amount of language other than English used in the home, and with occupation of parent for the limited range of occupations represented in the samples. They had reasonable reliabilities, were relatively easy to administer and were relatively interesting for the pupils.

On the basis of this and similar evidence, the Canadian Department of Northern Affairs undertook the Mackenzie District Norming Project, the report of which presents norms for several of these tests, for Eskimo, Indian-Metis, and Whites separately, based on samples representative of the whole of the Mackenzie District of the Northwest Territories.

C. Longitudinal Prediction, 1961-62 to 1965

The second and main problem of this paper examines the relative predictive validity, from 1961-62 to 1965, of several of these measures of intellectual potential for 45 of the 75 Faust Metis who were in Grades 1 to 3 in 1961. Fortunately, the 45 who were in Faust in 1965 did not differ significantly from the 75 who were there in Grades 1 to 3 in 1961, on mean grade in 1961, mean age in 1961, sex, mean occupational index, or mean I.Q. as assessed by the California Test of Mental Maturity, Progressive Matrices, and Detroit Beginning. Some descriptive data for this Faust Metis 1961-65 prediction sample, and also for two Eskimo 1962-65 prediction samples from Inuvik and Tuktoyaktuk, are reported in Table 3.

We shall skip lightly over Table 4 which, for those who are interested in factor analysis, throws more light on the factorial validity of these measures for two groups of which our Faust prediction sample forms part. The methodology of Table 4 may also be of interest to factor analysts; principle-factor analysis (inserting unities in diagonals and considering as significant those common factors whose corresponding eigenvalues were greater than one) was followed by varimax rotation and then by oblique promax rotation. Oblique factor patterns are useful in helping to conceptualize a hierarchical organization of abilities.

Tables 5, 6 and 7 present the core of this paper. Table 5 reports for the Faust Metis prediction sample, predictive validity coefficients between mental ability tests administered in 1961 and California Achievement tests administered in 1965. The upper half of Table 5 shows correlations based on scores normalized over this group, and the lower half correlations based on I.Q.'s for the mental ability tests.

Table 6 shows that for the same Metis group, using California Achievement Total in 1965 as the criterion, the so-called "culture-reduced" measures Coloured Progressive Matrices and SCRIT do not differ significantly from any of the "conventional" ability tests listed down the left, in their predictive validity coefficients.

Table 7 reports for the two Eskimo samples, very useful predictive validity coefficients between "culture reduced" ability tests administered in 1962 and Vernon achievement tests administered in 1965. "Conventional" ability predictors were not available for the Eskimo, for comparison purposes.

It should be pointed out that for all three samples, during the prediction interval no special treatment programs were instituted for those pupils beyond the usual programs of the schools concerned.

D. Discussion

One might now ask -- what is there about such tests as Progressive Matrices that helps them, at least for our samples, meet these criteria taken together less badly than do conventional group so-called intelligence tests?

A few slides might be useful at this point. (Guilford's and Vernon's hierarchical models, map of Mackenzie District, pupils and schools, items from Progressive Matrices and SCRIT).

Three replies suggest themselves: (a) the items form something of an age-scale sampling stages in the development of human cognition, starting with perception-dominated items, and proceeding through reversible concrete operations, to propositional or formal operations; (b) they use as stimuli symbols, which though dependent on learning are likely to be learned in a variety of cultures; (c) arrangement of items in the test itself forms a crudely-programmed sample of learning-on-the-spot. These suggest three directions in which continued research should help us considerably with the practical problems of assessing the general intellectual potential of individual candidates from other cultures.

An additional conclusion, if the validity data presented here are accepted, is that large proportions of Canadian native peoples of early school age have the general intellectual ability which seems necessary to participate fully in the larger Canadian community. This slide shows scores from the Mackenzie District Norming Project, on Progressive Matrices for Eskimo (Blue), Indian Metis (Red), and Whites (Green), for 7-year-olds on the left and 9-year-olds on the right.

The cross-bar in the centre of each line shows that the average of White pupils tends to be higher, but the length of each vertical line represents the spread from the 10th to the 90th percentile for each group. Note the great overlap between ethnic groups, with very many Eskimos and Indian Metis scoring higher than many Whites. The similar slide for 11 and 13 year olds shows that the overlap tends to decrease with age, native pupils dropping somewhat relative to Whites as they get older.

This study is part of a long-term project concerned not only with abilities least affected by particular backgrounds, but also perhaps much more important -- what abilities are <u>most</u> affected by particular environment influences, and what particular environmental influences affect the development of what particular abilities? It is expected that this larger project can in turn contribute to plans for an international study of circumpolar peoples, with some replication in Central Africa, as part of the International Biological Programme. The writer is fortunate to be a member of a Working Party of the International Union of Psychological Science, convened by Simon Biesheuval of South Africa and meeting in London, England in September, to advise the IBP concerning a battery of psychological measures capable of application in widely varying cultural settings, as part of the worldwide International Biological Programme.

E. <u>In Summary</u>

For a sample of Metis pupils at Faust, Alberta and two samples of Eskimo pupils, culture-reduced measures which in addition to having high loading on general intellectual ability and showing less bias against Canadian pupils than do conventional tests, also predicted school achievement over a four-year period

in general not significantly different from conventional tests, included Progressive Matrices, Safran-Culture-Reduced Intelligence Test, and some sub-tests of Lorge-Thorndike Non-Verbal Intelligence Test.

Three characteristics of such tests were suggested as indications of directions in which further research in this connection might proceed. An additional conclusion was that large proportions of Canadian native pupils of early school age have the general intellectual ability which seems necessary to participate fully in the larger Canadian community.

HANDOUT FOR

LONGITUDINAL PREDICTION OF SCHOOL ACHIEVEMENT FOR METIS AND ESKIMO PUPILS

R.S. MacArthur, University of Alberta
(Paper presented to 1967 CCRE Conference on Educational Research, Winnipeg, June, 1967)

A. Problem.

1. To briefly review illustrative cross-sectional evidence of the construct validity of certain measures of intellectual potential for Canadian native pupils.

2. To examine the relative predictive validity, over a four-year period, of several measures of general intellectual ability for a sample of M is pupils at Faust, Alberta, and two samples of Eskimo pupils at Inuvik and Tuktoyaktuk, N.W.T.

B. Illustrative Cross-Sectional Evidence of Construct Validity, 1961.

Criteria for Construct Validity - high loading on general intellectual ability as indicated by principal factor analysis, relatively less bias against Metis than commonly-used group intelligence tests, and moderate correlation with school achievement.

Sample - 147 Metis of both sexes attending school at Faust, 4 groups reported here; low socioeconomic status (Blishen Index Mean 38, S.D. 5.2) language other than English (Cree, some French) used in home on average more than half-time.

TABLE 1

Mean T-scores Based on Edmonton or Calgary Samples
(White urban Means are 50, S.D. of 10, in each instance.)

	Gr. 7 & 8 in Edmonton T		Gr. 5 & 6 in Calgary T		Gr. 2 & 3 in Calgary T		Gr. 1 in Calgary T	
	Faust	Simpson	Faust	Simpson	Faust	Simpson	Faust	Simpson
1. Prog. Mat.	41	45*	37*	40*	35*	36*	41*	41*
2. Cattell	41	41*	38*	39*				
3. SCRIT			36*	39*	38*	40*	49*	41*
4. L-Th. 3	43*	46*	34	29	45*	37*	43*	40*
5. L-Th. 2	41	45*	34	29	41*	40*	45*	39*
6. L-Th. 1	47*	45*	37*	34*	29	20	38*	32
7. L-Th. Tot.	42*	45*	31	27	33	24	39*	35*
8. CTMM Non-Lang.	43*	41*						
9. CTTM Spat.	46*	45*						
10. CTMM Tot.	36	31			29	21		
11. Detroit							35	27
	*Sig.Diff.from CTMM Total at .01 level		*Sig.Diff.from L-Th.Total at .01 level		Sig.Diff.from CTMM Total at .01 level		*Sig.Diff.from Detroit at .01 level	

NOTE: Means from a replication of the Faust study on a larger sample of Metis and Indians attending school at Ft. Simpson, N.W.T., are included in this table.

TABLE 2

Summary Evaluation of Nine Culture-Reduced Tests

	Mdn. 1st Unrot. Fact.	Mdn. Communality	Mdn. of Mean T-scores	Mdn. r Schl.Achiev.
1. Prog. Mat.*	.79	.80	41	.54
2. Cattell*	.77	.78	40	.49
3. SCRIT*	.74	.80	40	.48
4. L-Th. 3	.65	.82	42	.39
5. L-Th. 2	.72	.74	41	.52
6. L-Th. 1	.60	.73	36	.40
7. L-Th. Tot..	.77	.67	34	.60
8. CTMM Non-Lang.	.48	.87	42	.31
9. CTMM Spat.	.44	.78	46	.29
10. CTMM Total			30	.54
11. Detroit	.56	.79	31	.40

*Tests best meeting criteria adopted for construct validity.

C. Longitudinal Prediction, 1961-62 to 1965

TABLE 3

Some Descriptive Data for Three Prediction Samples

Status in 1965		Faust Metis 1961-65	Eskimo Young 1962-65	Eskimo Middle 1962-65
N		45	64	37
Age	Mean	12-6	11-3	13-11
	Range	9-8 to 15-3	9-3 to 12-3	12-4 to 15-1
Grade	Mean	5.7	3.7	5.8
	Range	3 to 7	1 to 7	3 to 8
SES	Mean	38	38	38
	Range	30 to 57	30 to 57	30 to 57
Sex	M	24	36	18
	F	21	26	19
Mean I.Q. in 1961 Progressive Matrices		102		
CTMM		90		

TABLE 4

Factor Patterns, Faust Indian Metis Age 9 to 12 and Age 12½ to 15½ in 1965
(N's of 56 and 54 respectively. Factor coefficients below .3 omitted.)

Tests	Unrotated 1st Factors Age 9 to 12	Unrotated 1st Factors Age 12½ to 15½	Promax Oblique Age 9 to 12 I v:ed	Promax Oblique Age 9 to 12 II Reas. NVS	Promax Oblique Age 9 to 12 h^2	Primary Factor Patterns Age 12½ to 15½ I v:ed	Primary Factor Patterns Age 12½ to 15½ II Reas. NVS	Primary Factor Patterns Age 12½ to 15½ III Field. Ind.	Primary Factor Patterns Age 12½ to 15½ h^2
1. Embedded Figures (Vernon)	.72	.63	.57		.52			.79	.73
2. Progressive Matrices Std.	.68	.86		.82	.66		.40	.38	.76
3. SCRIT	.65	.79	.61		.44	.33		.68	.79
4. MAC 2	.61	.50		.39	.40			.71	.52
5. Lorge-Th. NV 1	.54	.60	.30	.99	.66		.76		.55
6. Lorge-Th. NV 2	.74	.76	.34	.49	.59	.46		.42	.64
7. Lorge-Th. NV 3	.63	.77		.99	.73		.69	.35	.75
8. Cattell test of g	.62	.69		.70	.52		.82	.35	.78
9. Abstraction,vbl. induction	.83	.88	.46	.45	.71	.50		.35	.78
10. CTMM Non-Language	.71	.60	.72		.52		.54		.42
11. CTMM Verbal	.77	.73	.72		.60	.95			.79
12. Calif. Reading Vocabulary	.85	.72	.97		.81	.68			.65
13. Calif. Arith. Fundamentals	.90	.71	.91		.85		.59		.58
14. Calif. Reading Comprehension	.86	.85	.83		.77	.66			.77
15. Calif. Language Mechanics	.77	.82	.56		.59	.65	.35		.76
16. Calif. Spelling	.85	.75	1.00		.82	.83			.75
17. Oral Information	.89	.49	.90		.83	.85	-.50		.61
18. Grade	.81	.71	1.06		.80	.55	.44		.64
Proportions of Total Variance	.57	.52	.45			.27			
			-.01	.22		.03	.19		
						.01	.04	.14	
					.66				.68

Correlations of Oblique Primary Factors	I	II		I	II	III
I v:ed	-			-		
II Reasoning from Nonverbal Stimuli	.70	--		.56	--	
III Field-Independence				.45	.45	---

TABLE 5

Correlation Coefficients between Mental Ability Tests Administered in 1961 and California Achievement Tests Administered in 1965

Faust Metis. Sample (N=45)

1961 Predictors	1965 Achievement Criteria Calif.Rdg.	Calif.Arith.	Calif.Lang.	Calif.Total
Normalized Scores				
Progressive Matrices	.57	.52	.49	.57
SCRIT	.60	.56	.57	.62
CTMM Spatial	.48	.39	.24	.37
CTMM Non-Language	.59	.54	.37	.50
CTMM Logical	.54	.61	.50	.59
CTMM Numerical	.59	.65	.39	.52
CTMM Verbal	.57	.51	.46	.54
CTMM Language	.70	.74	.56	.68
CTMM Total	.70	.71	.50	.64
Intelligence Quotients				
Prog. Mat. I.Q.	.44	.30	.48	.47
CTMM Non-Lang. I.Q.	.35	.21	.24	.30
Detroit Beg. I.Q.	.37	.37	.43	.42
Lorge-Th. I.Q.	.24	.22	.40	.30
CTMM Lang. I.Q.	.46	.39	.46	.48
CTMM Total I.Q.	.45	.33	.40	.43

TABLE 6

Significance Levels of Differences in Correlation Coefficients with 1965 California Total Achievement Scores for Culture-Reduced and Conventional 1961 Predictors.

Faust Metis Sample (N=45)

Normalized Scores	r with Achiev.	Prog.Mat. .57	SCRIT .62	CTMM Spat. .37	CTMM N-L .50
CTMM Log.	.59	--	--	--	--
CTMM Num.	.52	--	--	--	--
CTMM Vbl.	.54	--	--	--	--
CTMM Lang.	.68	--	--	**	*
CTMM Total	.64	--	--		
Intelligence Quotients		**Prog.Mat. I.Q. .47**		**CTMM N-L I.Q. .30**	
Detroit Beg. I.Q.	.42	--		--	
Lorge-Th. I.Q.	.30	--		--	
CTMM Lang. I.Q.	.48	--		--	
CTMM Tot. I.Q.	.43	--			

-- Not significant at .05 level.
* Significant at .05 level.
** Significant at .01 level.

TABLE 7

Correlation Coefficients between Mental Ability Tests Administered in 1962 and Vernon Achievement Tests Administered in 1965. Eskimo Samples

Sample	1962 Predictors	1965 Achievement Criteria Vern. Eng.	Vern. Arith.	Vern. Vocab.
Esk. Young N = 62	Prog. Mat. Cld.	.42	.45	.42
	Otis Alpha N.V.	.59	.69	.61
Esk. Middle N = 37	Prog. Mat. Std.	.62	.69	.49
	L-Th. N.V.Level 3	.71	.71	.66

D. Discussion

E. Some Directly Relevant References

1. Elley, W.B. and MacArthur, R.S. "The Standard Progressive Matrices as a Culture-Reduced Measure of General Intellectual Ability." Alta. Journal Ed. Res., VIII, I, (March, 1962), 54-65.

2. MacArthur, R.S. "The Coloured Progressive Matrices as a Measure of General Intellectual Ability for Edmonton Grade III Boys." Alta. Journal Ed. Res., VI, 2, (June, 1960), 68-75.

3. MacArthur, R.S. Assessing the Intellectual Ability of Indian and Metis Pupils at Fort Simpson, N.W.T. Ottawa: Department of Northern Affairs and National Resources, 1962.

4. MacArthur, R.S. "The Intellectual Ability of Metis Pupils at Faust, Alberta," in Card, B.Y. et al, The Metis in Alberta Society. Edmonton: University of Alberta Committee for Social Research,1963.

5. MacArthur, R.S. Mackenzie District Norming Project. Ottawa: Department of Northern Affairs and National Resources, 1965.

6. MacArthur, R.S. "Mental Abilities in Cross-Cultural Context." Paper presented to Department of Psychology Colloquium, McGill University, March, 1966.

7. MacArthur, R.S. "Differential Abilities of Eskimo Youth in Relation to Those of Their White Classmates." Paper presented at Annual Meeting of Canadian Psychological Association, Ottawa, May, 1967.

8. MacArthur, R.S. "Sex Differences in Field-Dependence for the Eskimo." International Journal of Psychology (accepted for publication).

9. MacArthur, R.S. and Elley, W.B. "The Reduction of Socioeconomic Bias in Intelligence Testing." Br. Jrnl. Ed. Psych. XXXIII, 2, (June, 1963), 107-119.

10. MacArthur, R.S., Irvine, S.H. and Brimble, A.R. Northern Rhodesia Mental Ability Survey, 1963. Lusaka, Northern Rhodesia; Rhodes-Livingstone Institute, 1964.

11. MacArthur, R.S. and Mosychuk, H. "Lower and Upper Socioeconomic Group Contrast in Long-Term Predictability of Grade Nine Achievement." Journal of Ed. Measurement, III, 2, (Summer 1966), 167-168.

12. Olson, D.R. and MacArthur, R.S. "The Effect of Foreign Language Background on Intelligence Test Performance. "Alta Journal Ed. Res., VIII, 3, (Sept. 1962), 157-167.

13. West, L.W. and MacArthur, R.S. "An Evaluation of Selected Intelligence Tests for Two Samples of Metis and Indian Children." Alta Journal Ed. Res., X, 1, (March, 1964).

14. Rattan, M.S. "Predictive Validity and Stability of Measures of Intellectual Potential for Two Samples of Indian-Metis and Eskimo Children." Unpub. M.Ed. Thesis, Univer.of Alberta, 1966.